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[Title of the Invention] IMAGE PROCESSING APPARATUS AND METHOD

[What Is Claimed Is:]

[Claim 1] An image processing apparatus, characterized by comprising

first input means for inputting an image signal,

second input means for inputting position information indicating an arbitrary position of an image and image data in the arbitrary position,

extracting means for extracting the image data in the position corresponding to the position information from the image signal input by said first input means,

setting means for setting an image processing parameter on the basis of the image data extracted by said extracting means and the image data input by said second input means, and

processing means for processing the image signal input by said first input means by using the image processing parameter set by said setting means.

[Claim 2] The image processing apparatus according to claim 1, characterized in that said first input means inputs an image signal output from image sensing means.

[Claim 3] The image processing apparatus

according to claim 1, characterized in that said setting means sets an image processing parameter for converting the image data extracted by said extracting means into the image data input by said second input means.

[Claim 4] The image processing apparatus according to claim 1, characterized in that said processing means performs color balance processing by using the image processing parameter set by said setting means.

[Claim 5] The image processing apparatus according to claim 1, characterized in that said processing means performs white balance processing when said setting means sets no image processing parameter.

[Claim 6] An image processing method, characterized by comprising

the first input step of inputting an image signal,

the second input step of inputting position information indicating an arbitrary position of an image and image data in the arbitrary position,

the extraction step of extracting the image data in the position corresponding to the position information from the image signal in the first input step,

the setting step of setting an image processing parameter on the basis of the image data extracted in

the extraction step and the image data input in the second input step, and

the processing step of processing the image signal input in the first input step by using the image processing parameter set in the setting step.

[Claim 7] An image processing apparatus characterized in that said apparatus adjusts a hue of an input image signal, and comprises

input means for inputting color information with respect to a specific region which forms a part of an image, and

determining means for determining a hue of a whole image represented by the image signal on the basis of the color information.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an image processing apparatus and method and, for example, an image processing apparatus and method of adjusting the hue of an input image signal.

[0002]

[Prior Art]

In a television camera using an image sensing device such as an image sensing tube or a CCD, the level of a color signal consisting of a plurality of

components constituting an image signal output from the image sensing device must be adjusted such that the respective components are balanced with each other.

[0003]

In order to achieve the above object, so-called white balance adjustment is normally performed in this type of television camera so that an object which is supposed to look white looks white.

[0004]

Generally, the white balance adjustment amplifies and corrects a plurality of color component signals constituting an image signal. Consequently, the output levels of the color component signals are so adjusted as to be equal to each other with respect to an object which is supposed to look white.

[0005]

[Problems That the Invention Is to Solve]

However, the above-described technique has the following problems. The method of adjusting the hue of an image by adjusting the white balance is effective when a sufficient number of objects which are supposed to look white exist in an image signal obtained from an image sensing device or the like. However, no such object which is supposed to look white exists in an image signal or only a very few such objects exist in an image signal in many instances. In these instances,

therefore, it is in principle impossible to adjust the hue by adjusting the white balance.

[0006]

The present invention has been made to solve the above problems, and has as its object to provide an image processing apparatus and method capable of adjusting a color balance even when no object which is supposed to look white exists or only a few such objects exist.

[0007]

[Means of Solving the Problems]

The present invention has the following configuration as one means to achieve the above object.

[0008]

An image processing apparatus according to the present invention is characterized by comprising first input means for inputting an image signal, second input means for inputting position information indicating an arbitrary position of an image and image data in the arbitrary position, extracting means for extracting the image data in the position corresponding to the position information from the image signal input by the first input means, setting means for setting an image processing parameter on the basis of the image data extracted by the extracting means and the image data input by the second input means, and processing means

for processing the image signal input by the first input means by using the image processing parameter set by the setting means.

[0009]

Also, an image processing apparatus for adjusting a hue of an input image signal is characterized by comprising input means for inputting color information with respect to a specific region which forms a part of an image, and determining means for determining a hue of a whole image represented by the image signal on the basis of the color information.

[0010]

An image processing method according to the present invention is characterized by comprising the first input step of inputting an image signal, the second input step of inputting position information indicating an arbitrary position of an image and image data in the arbitrary position, the extraction step of extracting the image data in the position corresponding to the position information from the image signal input in the first input step, the setting step of setting an image processing parameter on the basis of the image data extracted in the extraction step and the image data input in the second input step, and the processing step of processing the image signal input in the first input step by using the image processing parameter set

in the setting step.

[0011]

[Embodiments]

An image processing apparatus according to an embodiment of the present invention will be described below in detail with reference to the accompanying drawings.

[0012]

Fig. 1 is a block diagram showing the constitution of an image processing apparatus according to an embodiment of the present invention.

[0013]

Referring to Fig. 1, reference numeral 10 denotes a color image sensing unit, e.g., a digital camera including an image sensing device such as an image sensing tube or a CCD. The color image sensing unit 10 senses the image of an object and outputs two-dimensional digital data as the image sensing data of the object. Reference numeral 20 denotes a color image reproduction processor for performing image reproduction processing for the output two-dimensional digital data transmitted from the color image sensing unit 10. For example, the color image reproduction processor 20 converts the two-dimensional digital data into digital NTSC-RGB data and outputs the converted data. Reference numeral 30 denotes a color image

reproducing display consisting of, e.g., a color video card and a monitor. The color image reproducing display 30 receives the output color image signal from the color image reproduction processor 20 and displays it as a color image on the monitor.

[0014]

Although not shown in Fig. 1, the apparatus of this embodiment can be connected to a printer which receives the output color image signal from the color image reproduction processor 20 and records the color image on a recording medium. The apparatus can also be connected to an image storage device or a personal computer as well as to a printer.

[0015]

The color image reproduction processor 20 performs various processes necessary for color image reproduction. In the following description, processing of color balance adjustment performed by the color image reproduction processor 20 and the configuration for the processing will be explained. Normal color image reproduction requires various processes and components not clearly explained and illustrated in the drawings. However, these processes and components are well known to those skilled in the art, so a detailed description thereof will be omitted.

[0016]

The color image reproduction processor 20 includes the following components. That is, reference numeral 21 denotes an image sensing data holding mechanism for holding the output digital image sensing data from the color image sensing unit 10; 22, an image sensing data extracting mechanism for extracting a portion of the image sensing data; and 24, an image position indicating mechanism for indicating an image position of the image sensing data to be extracted by the image sensing data extracting mechanism 22.

[0017]

Reference numeral 25 denotes an image data input mechanism for inputting data that the image data in the indicated position finally takes. Reference numeral 23 denotes an image reproduction parameter determining mechanism for determining an image reproduction parameter by using the input image data from the image data input mechanism 25 and the image sensing data extracted by the image sensing data extracting mechanism 22. A color balance adjusting mechanism 26 adjusts the color balance of the image sensing data, when an image is reproduced, by using the image reproduction parameter determined by the image reproduction parameter determining mechanism 23.

[0018]

Reference numeral 27 denotes a control unit

consisting of, e.g., a CPU, a program ROM, a work RAM, and an I/O device. The control unit 27 executes the color image reproduction processing by controlling the above components and components not shown in Fig. 1.

[0019]

The operation of this embodiment will be described below. Fig. 2 is a flow chart showing the operation of the color image reproduction processor 20, and particularly the procedure of color balance adjustment. This procedure is started by the control unit 27 when the input digital image sensing data from the color image sensing unit 10 is held in the image sensing data holding mechanism 21.

[0020]

In step S1, the control unit 27 checks whether an image position is indicated by the image position indicating mechanism 24. If no image position is indicated, the flow advances to step S11, and the color balance adjusting mechanism 26 performs normal white balance processing for the image sensing data held in the image sensing data holding mechanism 21, thereby obtaining reproduced image data. Thereafter, the processing is completed. On the other hand, if an image position is indicated, the indicated image position (to be referred to as an "indicated position" hereinafter) is sent to the image sensing data

extracting mechanism 22, and the flow advances to step S2. In step S2, it is checked whether the image data input mechanism 25 inputs image data.

[0021]

An example of the white balance processing usually performed will be described below. Note that this white balance processing is done on the basis of image sensing data. To perform the white balance processing, it is necessary to extract light source information from image sensing data. Generally, the color balance is adjusted on the basis of the extracted light source information, and the white balance processing is performed such that the color of the light source becomes white. Accordingly, if the light source information is not correctly extracted, incorrect white balance processing is performed.

[0022]

An example of the method of extracting the light source information from image sensing data is as follows. It is generally considered that in an image sensed by using reflected light from an object, a region (white region) having the light source information has a high luminance. Therefore, each color data in a region having the highest luminance in image sensing data is used as the light source information. This method is effective when all regions

in image sensing data are obtained by using reflected light from an object and a white region is contained in the image. However, if an image has no white region or a luminescent body is included in the image, a region having a high luminance may not necessarily have the light source information. If this is the case, it is sometimes not possible to accurately extract the light source information.

[0023]

A method other than the above method is to obtain the light source information by calculating the average of image sensing data, i.e., all pixels, constituting an image, for each color. This method is useful when all colors in an image are evenly present with no difference between them. Generally, however, a large amount of a certain specific color component often exists, and in this case it is not possible to accurately obtain the light source information.

[0024]

It is known that common light sources excluding some special light sources exist in a certain chromaticity range. If the characteristics of a color filter used in photography are known, the range of the existence of image sensing data having the light source information can be set from the above relationship. Accordingly, image sensing data can be extracted more

accurately by sampling image sensing data in this range of existence from image sensing data constituting an image.

[0025]

More specifically, assume that color data obtained as image sensing data are (Ma,Gr,Ye,Cy). These data are normalized by the following equations:

$$Kmg = (Ma - Gr)/Gr$$

$$Kyc = (Ye - Cy)/Cy$$

[0026]

With respect to the light source, Kmg and Kyc fall within a certain range in accordance with the above relations. Therefore, data (Ma,Gr,Ye,Cy) in this range are stored as data of the light source information and averaged (i.e., the total sum of each color data of image sensing data meeting the condition is divided by the total number of sampling cycles). In this way, the light source information can be accurately obtained.

[0027]

The above method is performed singly, or in combination with another, as the white balance processing, and particularly as the method of extracting the light source information in the white balance processing.

[0028]

If no image data is input in step S2, the flow

advances to step S12. In step S12, the image sensing data extracting mechanism 22 extracts image sensing data corresponding to the indicated position and supplies the extracted image sensing data (to be referred to as "extracted data" hereinafter) to the image reproduction parameter determining mechanism 23. Upon receiving the extracted data, the image reproduction parameter determining mechanism 23 determines an image reproduction parameter by using the extracted data such that the reproduced image data in the indicated position becomes image data indicating white. The image reproduction parameter determining mechanism 23 supplies the determined image reproduction parameter to the color balance adjusting mechanism 26.

[0029]

On the other hand, if image data is input by the image data input mechanism 25, this image data (to be referred to as "designated data" hereinafter) is supplied to the image reproduction parameter determining mechanism 23, and the flow advances to step S3. In step S3, the image sensing data extracting mechanism 22 extracts image sensing data corresponding to the indicated position and supplies the extracted data to the image reproduction parameter determining mechanism 23. Upon receiving the designated data and the extracted data, the image reproduction parameter

determining mechanism 23 determines an image reproduction parameter by using the designated data and the extracted data such that the reproduced image data in the indicated position becomes the designated data. The image reproduction parameter determining mechanism 23 supplies the determined image reproduction parameter to the color balance adjusting mechanism 26.

[0030]

In step S4, the color balance adjusting mechanism 26 adjusts the color balance of the image sensing data held in the image sensing data holding mechanism 21 by using the image reproduction parameter obtained in step S3 or S12, thereby obtaining reproduced image data. Thereafter, the control unit 27 completes the processing.

[0031]

The reproduced image data thus obtained is supplied to the color image reproducing display 30 which in turn reproduces and displays the color image.

[0032]

In the above procedure, the coordinate positions of image sensing data on a two-dimensional plane and the coordinate positions of a reproduced image obtained by performing image reproduction processing for the image sensing data are indicated, and the reproduced image data (indicated data) in this indicated position

is supplied. Consequently, an image reproduction parameter is automatically determined on the basis of the image sensing data and the indicated data in this indicated position. Image reproduction processing is performed by using the image reproduction parameter thus determined. Accordingly, a reproduced image whose color balance is properly adjusted can be obtained with a simple operation.

[0033]

In particular, this embodiment is not limited to the color balance adjustment (white balance adjustment) based on white; that is, the color balance can be adjusted by using any arbitrary color. Therefore, objects applicable to the color balance adjustment are not limited, i.e., any arbitrary object can be selected.

[0034]

One example of the method of automatically determining an image reproduction parameter will be described below.

[0035]

Assume that image sensing data in a certain indicated position is obtained as (Mg,Gr,Ye,Cy) from the output of an image sensing device and image reproduction data (R,G,B) is obtained by performing the following conversion for the image sensing data (Ma,Gr,Ye,Cy).

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} a11 & a12 & a13 & a14 \\ a21 & a22 & a23 & a24 \\ a31 & a32 & a33 & a34 \end{bmatrix} \begin{bmatrix} k1 & Mg \\ k2 & Gr \\ k3 & Cy \\ k4 & Ye \end{bmatrix}$$

...(1)

[0036]

In the above equation, k1, k2, k3, and k4 are parameters for color balance adjustment, i.e., color balance adjustment gains in the data Mg, Gr, Cy, and Ye. Commonly, the default values of all these parameters are 1, and a11, a12,..., a34 are conversion matrix coefficients for converting (Mg,Gr,Cy,Ye) into (R,G,B). These conversion matrix coefficients are normally determined on the basis of the spectral sensitivity characteristics of an image sensing device used in photography or the characteristics of a colorimetric system used as an output image signal, and are generally fixed by setting.

[0037]

Commonly, the color balance adjustment is done by using the parameters k1, k2, k3, and k4. For example, assuming that image reproduction data in a certain image position is (R',G',B'), the parameters k1, k2, k3, and k4 are determined by the following equation such that image sensing data (Mg',Gr',Cy',Ye') is converted into image reproduction data (R',G',B'). In the following equation, the parameter k1 is set beforehand

as a constant, and an important factor in the color balance adjustment is the parameter ratio.

$$\begin{bmatrix} k2 \\ k3 \\ k4 \end{bmatrix} = \begin{bmatrix} a12 \cdot Gr' & a13 \cdot Cy' & a14 \cdot Ye' \\ a22 \cdot Gr' & a23 \cdot Cy' & a24 \cdot Ye' \\ a32 \cdot Gr' & a33 \cdot Cy' & a34 \cdot Ye' \end{bmatrix}^{-1} \begin{bmatrix} R' - a11 \cdot k1 \cdot Mg' \\ G' - a21 \cdot k1 \cdot Mg' \\ B' - a31 \cdot k1 \cdot Mg' \end{bmatrix} \quad \ldots(2)$$

[0038]

By the use of the above method, the image reproduction parameters k1, k2, k3, and k4 can be determined by using the image sensing data (Mg',Gr',Cy',Ye') in a certain indicated position and the designated data (R',G',B').

[0039]

[Modifications]

In the above embodiment, the image position indicating mechanism 24 can be so designed that an operator inputs numerical values (coordinates) by using a keyboard. Alternatively, dummy reproduced image data is obtained by performing image reproduction processing (e.g., white balance processing) using a default image reproduction parameter for the image sensing data held in the image sensing data holding mechanism 21, and displayed on, e.g., a monitor. In this case, an indicated position can be input by using a pointing device such as a light pen, a mouse, or a touch panel and a pointing mechanism. This further facilitates the operation.

[0040]

Furthermore, the value of color information (image data in an indicated position) in a particular region can be directly input from, e.g., a keyboard. Alternatively, it is possible to display a color palette previously stored in a ROM or the like on a monitor and allows an operator to choose a desired color from the palette. This further facilitates the operation. Also, a so-called color picker can be displayed on a monitor if an internal calculating unit is used. In this case, by using expressions representing the attributes of a color such as the hue, saturation, and lightness, it is possible to supply color information by using all or some of these attributes.

[0041]

The color information can also be conceptually supplied by using words or symbols. This is effective when there is a color that the user wants to reproduce more beautifully or to emphasize, i.e., when image reproduction is performed by using a stored color such as "color of sky", "color of leaf", "color of sea", or "color of skin".

[0042]

As described above, in this embodiment, the position of an image is designated, color information

pertaining to the designated position is input, and an image reproduction parameter is determined on the basis of image sensing data corresponding to the designated position and the input color information. Reproduced image data is obtained by performing image reproduction processing for the image sensing data by using the determined image reproduction parameter. Accordingly, the color balance of the whole image can be adjusted by using an object of an arbitrary color in an arbitrary position on the screen, for example. This solves the problem of white balance adjustment that the adjustment is impossible when an image has no white object or only a very few white objects exist in an image. Also, by supplying a color (e.g., "color of skin") that the user wants to reproduce more accurately, as color information, it is possible to accurately reproduce a place where the user wants to reproduce and a color belonging to the place, or a color that the user wants to reproduce.

[0043]

[Other Embodiments]

The object of the present invention is also achieved by supplying a recording medium on which the program code of software for realizing the function of the above-described embodiment is recorded to a system or an apparatus and reading out and executing the

program code stored in the recording medium by using a computer (or a CPU or MPU) of the system or apparatus, of course. In this case, the program code itself read out from the recording medium realizes the novel function of the present invention and the recording medium adapted to provide the program code constitutes the present invention. Examples of a recording medium for providing the program code include a floppy disk, a hard disk, an optical disk, a magnetooptical disk, a CD-ROM, a CD-R, a magnetic tape, a nonvolatile memory card, a ROM, and the like.

[0044]

Note that the present invention can be practiced in various forms as shown in the above-described plurality of embodiments. Therefore, the present invention can be theorized or implemented in software utilizing various information without departing from the scope and spirit of the present invention as described above. Alternatively, the present invention can be realized in algorithm without departing from the scope and spirit of the present invention as described above and can be applied to hardware or an apparatus which operates in accordance with the algorithm.

[0045]

[Effect of the Invention]

As described above, according to the present

invention, an image processing apparatus and method capable of adjusting a color balance even when no object which is supposed to look white exists or only a few such objects exist can be provided.

[Brief Description of the Drawings]

[Fig. 1]

Fig. 1 is a block diagram showing the configuration of an image processing apparatus according to an embodiment of the present invention.

[Fig. 2]

Fig. 2 is a flow chart showing an example of the operation of the color image reproduction processing unit shown in Fig. 1.

[Description of the Reference Numerals]

10	color image sensing unit
20	color image reproduction processor
21	image sensing data holding mechanism
22	image sensing data extracting mechanism
24	image position indicating mechanism
25	image data input mechanism
23	image reproduction parameter determining mechanism
26	color balance adjusting mechanism
27	control unit
30	color image reproducing display

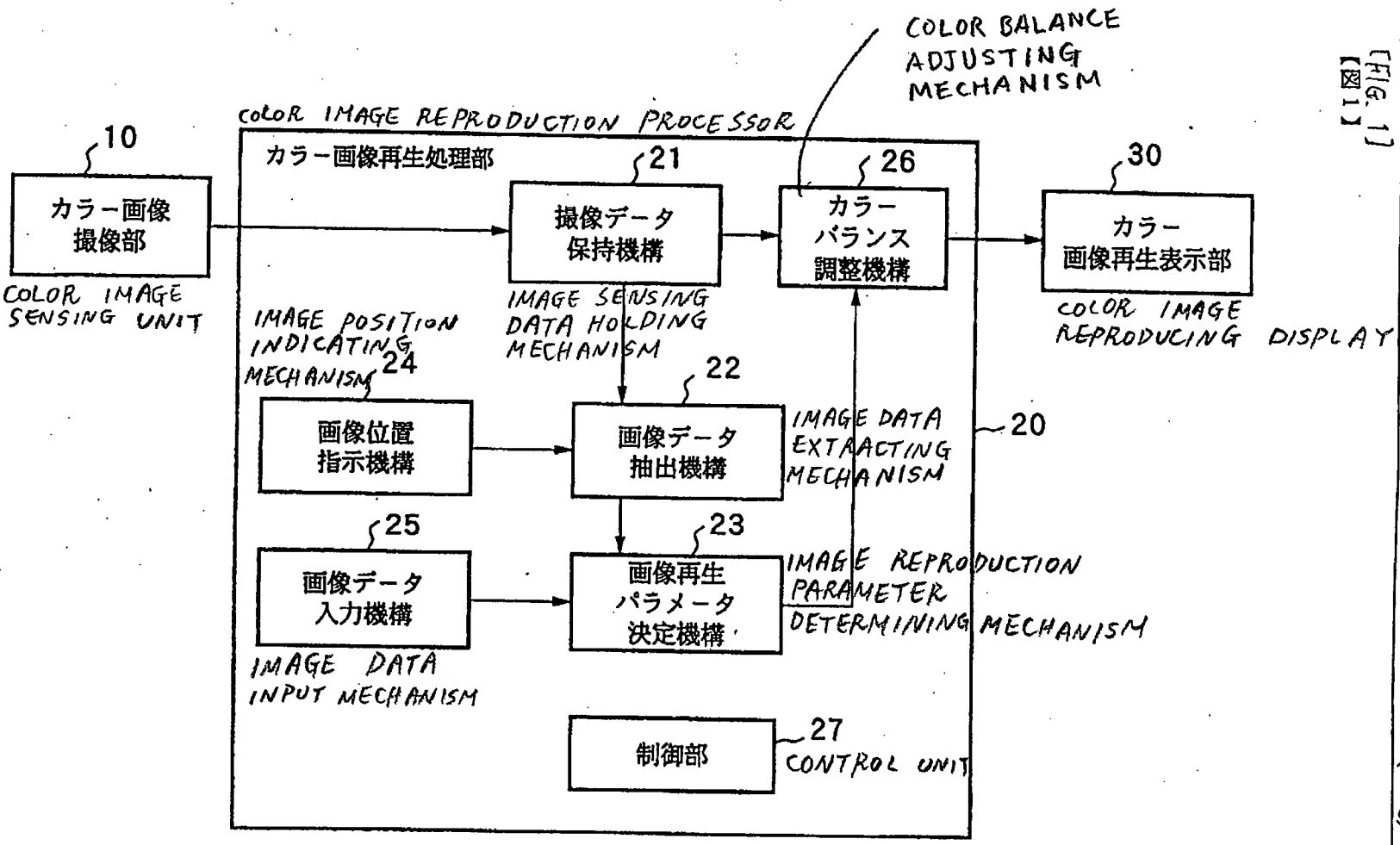
[Type of the Document] Abstract

[Abstract]

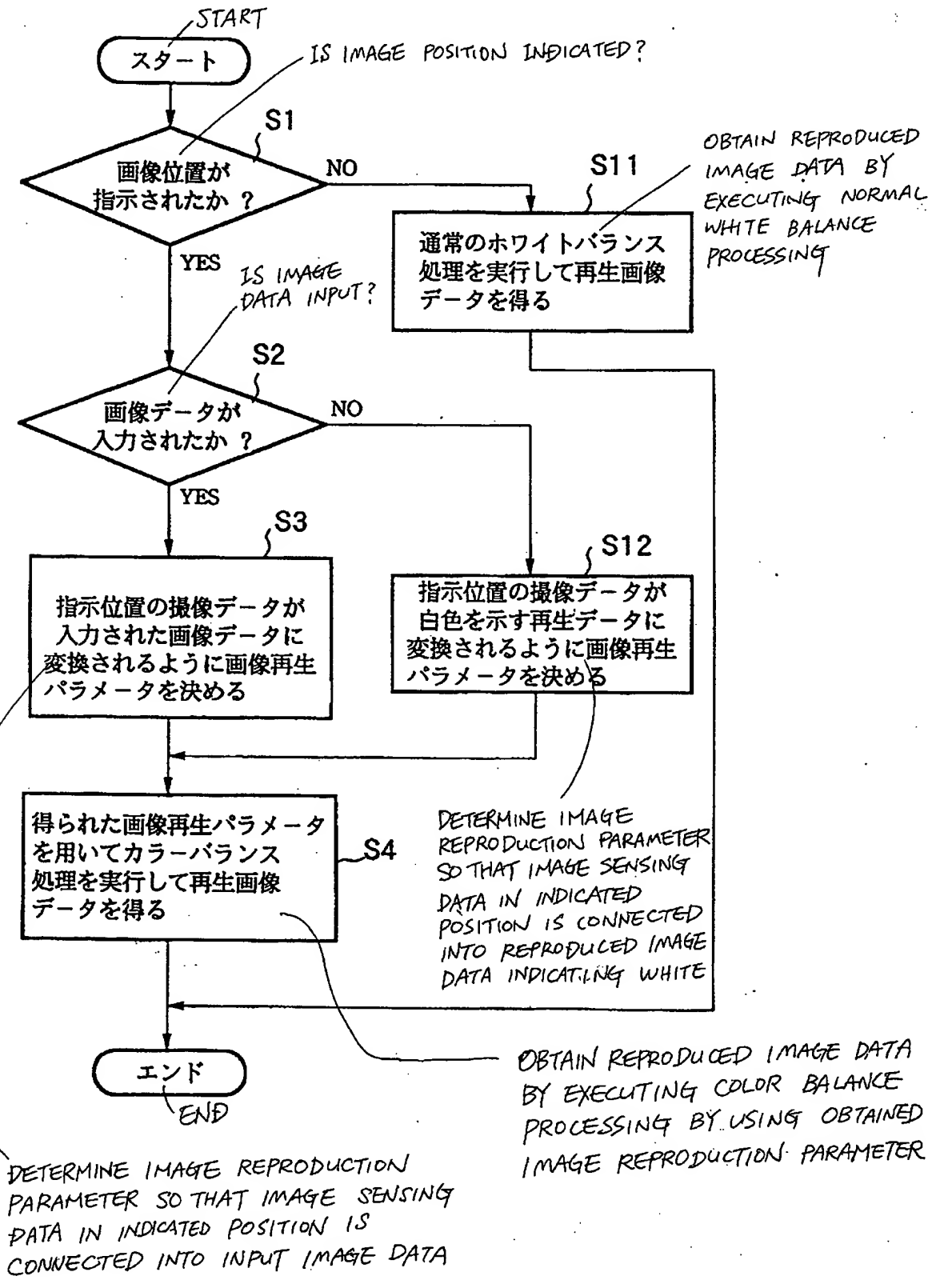
[Problem] It is an object of the present invention to provide an image processing apparatus and method capable of adjusting a color balance even when no object which is supposed to look white exists or only a few such objects exist.

[Solving Means] An image position indicating mechanism 24 indicates an arbitrary position of an image and an image data input mechanism 25 inputs image data in the indicated position. An image data extracting mechanism 22 extracts image data corresponding to the indicated position from image sensing data held in an image sensing data holding mechanism 21. An image reproduction parameter determining mechanism 23 determines an image reproduction parameter on the basis of the extracted image data and the input image data. A color balance adjusting mechanism 26 performs color balance adjustment for the image sensing data held in the image sensing data holding mechanism 21 by using the determined image reproduction parameter.

[Selected Drawing] Fig. 1


COLOR BALANCE ADJUSTING MECHANISM
COLOR IMAGE REPRODUCTION PROCESSOR
カラー画像再生処理部
10
カラー画像撮像部
COLOR IMAGE SENSING UNIT
21
撮像データ保持機構
IMAGE SENSING DATA HOLDING MECHANISM
26
カラーバランス調整機構
30
カラー画像再生表示部
COLOR IMAGE REPRODUCING DISPLAY
IMAGE POSITION INDICATING MECHANISM
24
画像位置指示機構
22
画像データ抽出機構
IMAGE DATA EXTRACTING MECHANISM
20
25
画像データ入力機構
IMAGE DATA INPUT MECHANISM
23
画像再生パラメータ決定機構
IMAGE REPRODUCTION PARAMETER DETERMINING MECHANISM
27
制御部
CONTROL UNIT

【図２】 FIG. 2.


START
スタート
IS IMAGE POSITION INDICATED?
S1
画像位置が指示されたか？
NO
YES
S11
OBTAIN REPRODUCED IMAGE DATA BY EXECUTING NORMAL WHITE BALANCE PROCESSING
通常のホワイトバランス処理を実行して再生画像データを得る
IS IMAGE DATA INPUT?
S2
画像データが入力されたか？
NO
YES
S3
指示位置の撮像データが入力された画像データに変換されるように画像再生パラメータを決める
S12
指示位置の撮像データが白色を示す再生データに変換されるように画像再生パラメータを決める
得られた画像再生パラメータを用いてカラーバランス処理を実行して再生画像データを得る
S4
DETERMINE IMAGE REPRODUCTION PARAMETER SO THAT IMAGE SENSING DATA IN INDICATED POSITION IS CONNECTED INTO REPRODUCED IMAGE DATA INDICATING WHITE
エンド
END
OBTAIN REPRODUCED IMAGE DATA BY EXECUTING COLOR BALANCE PROCESSING BY USING OBTAINED IMAGE REPRODUCTION PARAMETER
DETERMINE IMAGE REPRODUCTION PARAMETER SO THAT IMAGE SENSING DATA IN INDICATED POSITION IS CONNECTED INTO INPUT IMAGE DATA